# British Journal of Anæsthesia

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## EDITORIAL.

### Anaesthetics for Midwifery.

We make no apology for returning once more to the subject of anæsthesia for women in their confinements. The immediate justification, if one were needed, is to be found in contributions which appear at later pages in this number of the *Journal*. From these the reader will gather that in some quarters at least the latest, and perhaps most widely heralded device, e.g. chloroform capsules, is not accepted with unqualified gladness. It is doubtless too soon as yet to pronounce an absolute verdict. It must be remembered, too, that the great need is for an anæshetic, if there is indeed any such a one, which can be safely entrusted to the midwife. The problem is either to find this anæsthetic or to render the midwife so skilful as to be safe with some form of anæsthetic that we already have, or else to supply every patient who is attended by a midwife with an anæsthetist as well. It does not appear likely that the problem is going to be solved by the use of the one anæsthetic drug, chloroform, which of all others anæsthetists know to be full of potential danger. We doubt very much whether chloroform in any form whatever, capsule or otherwise, can be safely put into the hands of the midwife at large. An opinion of this kind will, of course, be at once chal-

lenged by the practitioner who has "given chloroform in my own practice hundreds of times and never had a moment's anxiety". Any one, however, who will calmly inspect all the evidence and regard his own practice in its proper perspective, will agree with the judgment of chloroform which is held almost without exception by anæsthetists of wide experience. That judgment is that danger arises more easily in association with the use of chloroform than with any other anæsthetic, and that it is not simply a question of dose reduction.

# SPINAL ANÆSTHESIA, HEAVY SOLUTION OR LIGHT?

By G. Falkner Hill, M.B.

*Lecturer on Anæsthetics, University of Manchester.*

Kelly, writing in the *Journal of the Michigan State Medical Society*, says: "With the very great increase in the literature on spinal anæsthesia it seems regrettable that many articles appearing in the current literature are written either by the proponents or opponents of the method, and their analysis of the subject is reflected by opinions already formed as to its value or lack of value."

Anyone who has had sufficient experience of spinal anæsthesia to justify them in putting other people to the trouble of reading what they write is almost certain to have formed a fairly definite opinion as to its value, and therefore may be said to be either a proponent or an opponent of the method. There is nothing regrettable in that. What is unfortunate is that prejudice should be allowed to form the basis of remarks which should only be made on the basis of experience and, if possible, extensive experience. I heard not very long ago a professorial criticism of the views of a well-known writer on international affairs. As the critic ended with the remark that he "loathed the Germans" it was impossible to attach any importance to his views, distorted as they were by his strong emotional bias. A passionless judgment, impossible as it may be to achieve in national affairs, ought surely not to be beyond the compass of anæsthetists anxious alike for the welfare of their patients and their own reputation.

Life is not long enough for all of us to have sufficient experience in every method of anæsthetizing patients to be able to make our own comparisons, and therefore we compare our methods with those of others and naturally are very apt to prefer our own, merely because they are our own. The personal bias tends to creep in. As far as possible the personal bias in the present series of cases has been

eliminated because the person is the same in them both, and the comparison is not between spinal anæsthesia and general anæsthesia or between one drug and another, or even between a simple novocain solution and a novocain gliadin mixture, but between two novocain gliadin mixtures, one of which is lighter than cerebro spinal fluid and the other of which is heavier than cerebro spinal fluid. The two solutions are compared under the following heads: 1—Composition; 2—Quickness of Action; 3—Power; 4—Duration; 5—Safety; 6—Effect on Blood-pressure; 7—Effect on Respiration; 8—Reliability; 9—Mortality; 10—Morbidity.

*Composition.*—Each solution is a 10 per cent novocain solution containing sufficient gliadin to increase the viscosity of the solution. One is made lighter than the cerebro spinal fluid by means of alcohol, and the other is made heavier than the cerebro spinal fluid, usually by the addition of glycerine.

*Quickness of Action.*—The heavy solution is much quicker in action than the light. Operations have occasionally been begun within two minutes of the injection. It is probable that the glycerine acts as a link between the nervous elements and the novocain, because if the solution is made heavy in some other way than by the addition of glycerine this extremely rapid action is not noticed.

*Power.*—I have been unable to detect any difference in the power of the two solutions, but one surgeon tells me that light duracain relaxes the sphincter ani more completely than the heavy. Both solutions give complete muscular relaxation of the abdominal wall.

*Duration.*—In equivalent doses I am inclined to think that the light solution gives a somewhat longer anæsthesia than the heavy, but as there is considerable variation between one individual and another, between one theca and another, and probably between the reaction of novocain to different nervous tissue, it is not a point on which I am prepared to be dogmatic. The longest time (two hours and six minutes) for a high abdominal was obtained with heavy duracain, though other anæsthetists using the light solution record still more prolonged anæsthesia.

*Safety.*—It is necessary to think of this in connection with

reliability. Both are absolutely safe in low anæsthesias because the only way in which novocain by its own action kills is by paralysing respiration. In endeavouring to get a high anæsthesia one is always between the Scylla of too low and the Charybdis of too high, and actually in practice I was unable to obtain a satisfactory high anæsthesia in more than 84 per cent of upper abdominal operations, when using the light solution. On the other hand, using heavy duracain the successes are in the neighbourhood of 100 per cent. The failures have so far in these 500 cases been due either to the fact that the operation took longer than expected, was a different operation to the one contemplated, or was an operation that outlasted the capability of the anæsthetic. There has not been a failure to get the anæsthesia high enough, nor has there been any high enough to interfere with respiration. On the score of safety and reliability combined the difference is enormously in favour of the heavy solution.

*Effect on Blood-pressure.*—The usual statement made as regards the effect of spinal anæsthesia on blood-pressure is to the effect that the fall is proportional to the height of the anæsthesia. Thus Pitkin: "If the anæsthesia fluid is confined to the lumbar spine there is no change in the blood-pressure; if it reaches the first thoracic the pressure becomes nil."

How it is possible for any clinician to make such a statement it is difficult to imagine. Perhaps it is not as a clinician that he makes it but as an experimenter. As regards clinical work, I have records of not one but dozens of cases in which the anæsthesia was in the neighbourhood of the first thoracic and the fall of blood-pressure was either slight or non-existent. The most striking recent instance of that sort occurred on December 3, 1932. The patient, a man, aged 46, in excellent condition, with a good heart and strong abdominal muscle, had had a gastro enterostomy performed two or three years before. A considerable improvement followed, but latterly symptoms had reappeared and it was thought that he might be the victim of a jejunal ulcer or possibly a commencing gastrocolic fistula. I was asked to arrange for a two-hour session. The anæsthesia lasted two

hours and was up to the fourth cervical, as evidenced by the fact that it was possible to close towel forceps in the skin covering both shoulder joints without the patient being able to feel them. The operation was much shorter than anticipated, nothing being found of a pathological nature except numerous adhesions. It lasted 45 minutes. Before the operation the blood-pressure was 120, during the operation it rose to 160 and returned to 120, at the end of the operation being 125. There was never at any time the slightest embarrassment of respiration and the patient could move his arms. Such a case demonstrates a good many things, but it definitely contradicts generalizations such as Pitkin's. Nor is the second part of his statement true either, viz., that if the anæsthetic be confined to the lumbar spine there is no fall of blood-pressure. We have all seen cases where the anæsthesia reached only to the umbilicus. True that is slightly above the lumbar spine, but it does not materially affect the argument, in which the radial pulse was so feeble that it was not possible to measure the blood-pressure; in two recent cases in which the anæsthesia did not go above this level the radial pulse was for a time so feeble as to make it impossible to take the blood-pressure; in the second case, in fact, the radial could not be felt. This means at least that even if the anæsthetic be confined to the lumbar spine the blood-pressure may fall to a point at which it is no longer measurable. There are, in fact, other causes of a fall of blood-pressure besides a spinal anæsthetic. The second of the two cases mentioned above was put into the steep Trendelenburg position, and he said afterwards that he thought that it was this turning upside down that had upset him. A sound sleep the night before the operation plus a sedative one hour before are the best preventatives of these alarming but usually quite harmless 'faints'. Though it is thus easy to contradict the too facile generalizations of Dr. Pitkin it is impossible to substitute any other to take their place. The reason of this is obvious when we consider the nature of blood-pressure.

As the physiological connection between different parts and systems of the body is continuously in existence it

follows that any modification of one part will be immediately met by necessary adaptations in other parts, and so a balance will be kept. The normal blood-pressure of any individual is such a physiological or dynamic balance. Although we know a number of proceedings which will disturb the blood-pressure and some of the mechanisms which operate immediately to limit or annul such disturbance, it is probable that we do not know them all. Moreover, in any given case it is impossible to assess accurately the part played by the various restorative mechanisms. Thus if we ascend a mountain or in any other way breathe an atmosphere in which the oxygen pressure is lowered this would immediately give rise to a lowered oxygen pressure in alveoli blood and tissues, were it not for compensatory measures such as increased breathing oxygen secretion and a rise in the percentage of $HbO_2$. But increased breathing makes the system more alkaline; it diminishes the hydrogen concentration of the blood were it not that the kidney decreases the amount of available alkali. The original decreased oxygen pressure is not compensated for then by some massive change as, for example, great increase in the breathing, because that would need other massive compensations, but by slight readjustments all round so that the normal relations of the tissues are maintained but at a different level. Similar adjustments are made when there is initiated a big change in one of the normal mechanisms maintaining blood-pressure. Thus Samson Wright and Kremer have shown that section of the splanchnics consecutively or even simultaneously is followed in half their cases by a slight fall of blood-pressure, and in the other half there is actually no fall at all. Though the blood-vessel area supplied by the splanchnics is in a state of dilation those above and below the splanchnic outflow are in a state of compensatory constriction, and therefore there is no fall of blood-pressure. It is unlikely that a heavy solution of duracain would affect the anterior roots of the dorsal nerves at a higher level than the fifth or sixth, and therefore would be even less likely than the section of the splanchnics to cause a fall of blood-pressure, and this is borne out in practice. The rule is that

the blood-pressure remains at its pre-anæsthetic level or even rises between the time of giving the ephedrin and anæsthetic and the commencement of the operation. The blood pressure falls as a rule only after the surgeon has explored the abdominal cavity or made traction on the stomach or duodenum. Not always then. The fall of blood pressure which takes place under these circumstances is in all probability not a simple phenomenon. It is partly physical and partly psychic. Afferent impulses passing up the vagus, which is beyond the reach of the spinal anæsthetic, reflexly affect the heart and lower the blood-pressure. There is no doubt that psychic influences also play a part and, indeed, often a large part; possibly at times are solely responsible for even a complete loss of measurable pressure. The two cases to which reference has been made above may be examples of a fall of blood-pressure due entirely to psychic influences, seeing that the anæsthesia did not extend above the umbilicus. As the fall of blood-pressure, which more often than not takes place immediately following the exploration of the abdomen, is as a rule only of a temporary nature, it is possible that it is due to the absorption of histamine in part at any rate. Howard Jones has suggested that it is due to the absorption of the anæsthetic itself into the blood. The normal blood-pressure curve which follows the intrathecal injection of percaine lends colour to this suggestion. As far as novocain is concerned there is neither clinical nor experimental evidence for this; the latter, indeed, very definitely contradicts it. There is a certain type of case which is an exception to the general rule that the blood-pressure does not fall until the abdomen is explored, and that is the acute perforation. In such a case the blood-pressure comes down with a run immediately the anæsthetic is given. It is probable that pressor impulses by way of the splanchnics are suddenly shut down by the S.A., and the recently overstimulated V.M.C. reacts to a quiescent period. Provided the coronary circulation is not dependent on the maintenance of a normal or nearly normal blood-pressure no harm results from such a fall which is gradually recovered from during the operation.

Confusion is apt to arise in the discussion of the fall of

blood-pressure unless it is made clear whether or we are dealing with man or animals.

Prof. Pannett, in an address to the Association of Surgeons of Great Britain and Ireland, suggests that the fall of blood-pressure which follows the injection of 0.4 c.c. of a 5 per cent solution of novocain into the theca of a cat is due to the dilatation of the vessels of the muscles of the legs; it may well be so. It will not, however, explain why the fall of blood-pressure in man only takes place as a rule after the abdomen is opened. If we compare the two cases we shall see that 0.4 c.c. of a five per cent solution of novocain is relatively a much larger dose of novocain given in a much larger bulk of solution. 0.4 c.c. in a cat is about equal to 12 c.c. in a man, and 20 mm. is about equivalent to 600 mm. I never use more than 300 mm. in 3 c.c., and that is perhaps why I seldom see a fall of blood-pressure before the abdomen is opened. There is not sufficient bulk of fluid to soak the anterior roots; particularly is this likely to be the case as the patient is immediately turned on to his back, whereas the cat is probably kept on its side. It is certain that the technique that I adopt paralyses the abnormal muscles for a longer period than the leg muscles, because it generally happens that the patient can move his feet while the abdominal muscles are still completely relaxed. It is almost certain that under some conditions the vessels and capillaries of the muscles are so relaxed as to be a big factor in the causation of a marked fall of blood pressure, e.g. in shock. The fact that intra-muscular injection of pitressin together with intravenous glucose saline will improve the condition of the moribund and save those who are only just short of it, tends, I think, to corroborate this view.

Pannett quotes Seevers and Waters as holding the opinion that the fall of blood-pressure is due to the "loss of inspiratory suction into the heart." On turning to their paper in the *Journal of the American Medical Association*, September 17, 1932, they say: "The fall in systolic pressure is directly proportional to the height of the block" (in dogs). This they attribute partly to V.C. paralysis and partly to intercostal nerve paralysis. Owing to the low blood pressure thus

induced the oxygenation of the blood begins to be deficient, and anoxæmic blood supplied to the heart causes first a weakening and subsequently a failure of that organ.

They say further: "A.R. alone with the Drinker respirator will maintain the blood pressure near its original level after a block paralysing all respiratory activity" Diaphragmatic and costal? So that V.M. paralysis doesn't matter. Also "Passive distension of the lungs with 100 per cent oxygen will maintain an adequate blood-pressure in the absence of any respiratory movement for at least fifteen minutes." So complete paralysis of the thoracic wall doesn't matter.

The essence of the matter, the *sine qua non*, then, is efficient oxygenation of the tissues, which can be achieved even in the presence of complete V.M. and respiratory paralysis.

*Effect on Respiration.*—Either solution will paralyse respiration if introduced into the cisterna magna or if introduced into the lumbar region and subsequently pushed up by the injection of saline it will paralyse the phrenics and intercostals. With the correct technique neither of these contingencies occur in clinical practice. With the light solution tingling of the fingers and some slight distress, some feeling of inability to breathe even though the actual ability be preserved occurs occasionally. With the heavy solution these slight inconveniences seldom occur, and it is quite possible to get analgesia ten segments higher than paralysis. The case quoted earlier in this paper is a remarkable example.

*Reliability.*—Little remains to be said on this head. In cases of operation on the upper abdomen the severest test of spinal anæsthesia, the light solution in my hands failed to reach the desired height in 16 per cent, whereas the heavy solution never fails to reach the correct height, but does not always last long enough to complete a very long abdominal operation.

*Mortality.*—This, of course, depends on how one selects cases. If the patient is strong, and has a sound heart, there should be no mortality with either solution; but this is not the case in practice. Confronted with a grave risk, advanced

peritonitis causing a high grade toxæmia, gall bladders with fat toxic "cholecystitic" hearts simulating or possibly actually being angina, a grave risk has to be taken, and in such a case if a spinal anæsthetic is decided on I am quite definitly of the opinion that the heavy solution is the one to choose. In the present series of 1,000 cases upon which these opinions are based I have seen three deaths in which the anæsthetic was a factor the solution in each case being the light. I have only seen one death on the table whilst using the heavy solution, and the anæsthetic had nothing to do with that fatality.

*Morbidity and Sequelæ.*—As far as I am aware there has been no morbidity or any undesirable sequel in this series with the exception of very occasional slight headache. One patient who had a very severe and prolonged (a fortnight) headache after percain given for a colostomy, had no headache following the exhibition of heavy duracain for the much more extensive operation of removal of the growth. Occasionally a patient has died within one to two hours of the operation. There has on all occasions but one been something definite to account for the death, such as the known presence of anginal attacks or the severity of the operation. In the one instance referred to the operation had been a double herniotomy on a man between 60 and 70. He died quite suddenly and unexpectedly three hours after receiving the anæsthetic (light duracain). The anæsthesia had been away for at least one and a half hours. He had felt a little breathless shortly after the beginning of the operation but that had all passed off, and towards the end of the operation he was joking with his doctor and after being carried back to bed moved his legs freely and had been talking in a perfectly normal way to his nurse for about one and a half hours when he suddenly appeared in distress, became deeply cyanosed, and died within three minutes. Save for a sudden drop and an equally sudden recovery of blood-pressure almost immediately the anæsthetic had been given, which must be put down to nervous apprehension, it ranged throughout the operation between 150 and 170 mm.Hg. It is difficult to see what part, if any, the anæsthetic played in this death.

# VARIATIONS IN THE PULSE-RATE AND BLOOD-PRESSURE DURING BASAL ANÆSTHESIA.

## With a Description of a Special Case.

By ARTHUR P. GORHAM, M.B.

*Anæsthetist, Royal Hospital Women and Children, Bristol.*

MARKED variation in pulse-rate and blood-pressure is not usual in the course of basal anæsthesia, but occurs in about 10 per cent of cases. It may do so quite unexpectedly, and the exact interpretation of the changes and the treatment to be given are of importance to surgeon and anæsthetist alike. Considerable anxiety may arise and doubt as to whether the surgical procedure is the cause or the anæsthetic is the responsible factor. It will be shown that the anæsthetic alone can give rise to wide variations.

All the observations here considered refer to experiences with tribromethanol (avertin) anæsthesia used in standard doses, i.e. 0.1 grm. per kg. body weight in $2\frac{1}{2}$ per cent aqueous solution.

*The Pulse-rate.* Previous to administration the pulse is usually slightly raised on account of apprehension. This can, of course, be eliminated to some extent by careful preparation and by putting the patient into a private room, but in hospital wards it is difficult to conceal the day of operation from the patient as the days for operating of most surgeons are too well known.

During administration the raised rate continues, but at the end of 30 minutes commences to fall and is often normal at the end of this time, which is the usual period of induction. After an hour it is commonly just subnormal unless any element of surgical shock is present, whan a raised rate will be found.

It is well to note in this connection that the speed will be slower even in fair degree of shock than that met with in ether or gas-oxygen anæsthesia.

In my series of cases the force of the pulse at first appears slightly increased, but later diminishes by an appreciable amount If this diminution be marked a corresponding slowing of the rate will be observed. The official booklet, *Avertin,* published by Bayers, notes that "no particular alteration in the pulse has been noticed. It is generally described as remaining practically unaltered, sometimes being slightly increased or fuller, sometimes as temporarily reduced."

The American experience has been that the pulse-rate is uot much altered, and if it is, it is due to operative trauma or loss of blood.

E. B. Parsons sums up the usual variation in stating that avertin causes a slight increase followed immediately by an appreciable diminution in the force of the beat, which is accompanied by a slowing of the rate.

*The Blood-pressure.* A fall in pressure is characteristic of this anæsthetic. The pulse-pressure remains unaltered or is slightly reduced. The fall in pressure is about the same as that met with in ether or spinal anæsthesia and is of no consequence. It has been stated that slow administration does away with this fall in blood-pressure, but in my hands this has not been found to obtain, the average fall being 25 mm. Hg. The pressure sometimes rises. This has been seen particularly in toxic thyroid cases and in sinus surgery of the head. A rise in 20 per cent of such cases has been noted. Occasional marked falls with good recovery take place and have been recorded by many anæsthetists. Such a case will now be described and would appear to be of special interest in that the fall of pressure was marked and was associated with a similar fall in the pulse-rate.

*Description of case.* The patient under review was a female aged 47, a children's nurse in a doctor's household. She was slightly anæmic, having had some uterine hæmorrhage due to fibrosis uteri for some six weeks previously. She weighed 8 st. 11 lb. and was highly nervous, so that 5.5 c.c. of avertin fluid, properly tested with Congo-red was administered per rectum in a 2.5 per cent aqueous solution at 35° C. The time taken to induce narcosis was 30 minutes, at the end of which time she was quietly asleep.

The operation consisted of a careful pelvic examination followed by moderate dilatation and curettage of the uterus. As she remained quite relaxed and still no other anæsthetic was used.

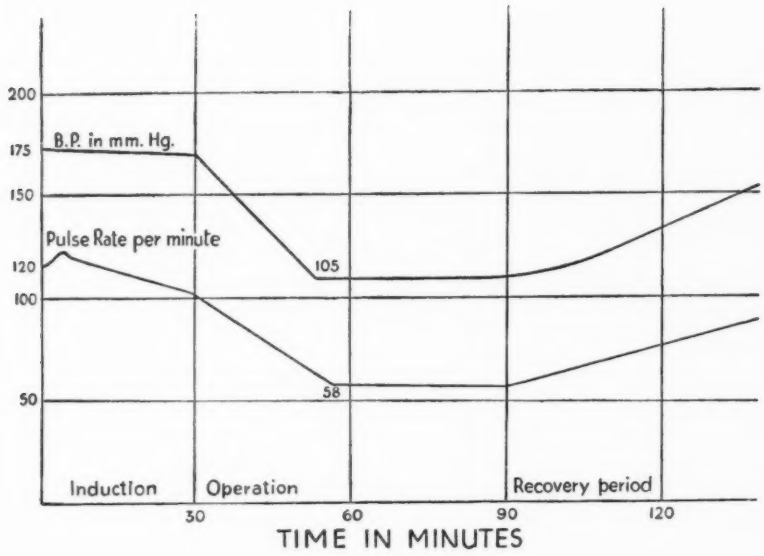
At the end of 50 minutes there was slight pallor and the respiration was diminished in frequency and force, as is commonly found in basal anæsthesia. The pulse-rate had fallen from 120 at the commencement to 58 beats per minute and the blood-pressure (systolic) from 175 to 105 mm. Hg. The pulse volume was good. She remained unconscious for three hours, slowly regaining her senses, being sleepy for five hours. In 24 hours she was quite recovered, having experienced some headache but with no recollection of ever having left her bed. The pulse-rate and pressure variations are shown in the accompanying graph.

## Discussion.

Certain factors must be considered as always operating in any given surgical procedure, namely (*a*) trauma, (*b*) anæsthesia, (*c*) hæmorrhage. Any of these may produce alterations in pulse and pressure, usually raising the former and reducing the latter.

In the case under review (*a*) and (*c*) were negligible, leaving the anæsthetic as the cause of the observed changes. There was in this instance no variation in the total volume of circulating blood sufficient to reduce the pressure to such a degree, nor was the peripheral resistance altered by any local influences on the musculature or by vasomotor changes. The main factor would therefore seem to be a diminished output of the left ventricle. The avertin would appear to have weakened the force of the beat seen in the diminished pulse. This was followed by a slowing of the rate with a fall in the blood-pressure. This is in agreement with the findings of Parsons in animal experiments, who states that the coronary vessels are dilated and the peripheral vessels constricted.

Kennedy has reported on a large number of cases using this anæsthetic, and finds a fall of blood-pressure usual, but that the greater the fall in pressure the faster the pulse beats. He has confirmed this under experimental con-


200
175
150
120
100
50
B.P. in mm. Hg.
Pulse Rate per minute
105
58
Induction
Operation
Recovery period
30
60
90
120
TIME IN MINUTES

ditions with young adults, and thinks that the beat-regulating centre is a factor, but not the only one. The pressures met with have been lower than is usually considered safe, but there has been good recovery.

In the case under consideration it must be concluded that the drug was producing definite toxic effects. There was a perfect recovery without any after-effects.

## Treatment.

In the treatment of these circulatory disturbances, ephedrine given hypodermically has been found to be valuable. If the respiration is depressed, causing cyanosis, the inhalation of small amounts of ether from the open mask often produces immediate stimulation and improvement. Carbon dioxide (5 per cent) with oxygen should also always be used, and very good results are obtained from its inhalation. For cardiac depression coramine is to be recommended, given in 1 to 2 c.c. doses intramuscularly or intravenously as the urgency of the case dictates.

Extra warmth, salines intravenously or rectally, and transfusion will be considered also in urgent cases when excessive hæmorrhage has arisen. Adrenalin should not be used with avertin.

## Summary.

1. Avertin normally produces little alteration in the pulse.

2. The blood-pressure is usually reduced and fairly frequently quite low levels are reached which need not give rise to anxiety and from which perfect recovery is made. The fall is normally accompanied by a raised pulse.

3. A case of a marked fall in both blood-pressure and pulse-rate is recorded with good recovery.

4. The respiration is diminished in frequency and force in this anæsthesia.

5. Suitable treatment for the above conditions is given.

# A DEATH UNDER ANÆSTHESIA*

By GILBERT BROWN, M.B., Ch.B.

*Honorary Anæsthetist, Adelaide Hospital.*

MRS. N. T., aet. 27, was admitted to a medical ward at the Adelaide Hospital suffering from exophthalmic goitre. As rest and medication did not produce much improvement, an operation was decided upon. Lugol's solution was administered intensively for seven days and on the evening prior to the operation she received 0.5 gm. (gr. 7½) of barbitone and slept well.

When examined in the ward at 9.10 a.m. on 23rd November 1932 there was no restlessness or obvious excitement. Her weight was 71.2 kilo (157 lb.), pulse rate 96, respiration 20 and the blood pressures 148 and 80 millimetres of mercury respectively. The basal metabolic rate had not been estimated, but by Read's formula it was calculated as +48, and by Gale's formula as +53.

The anæsthetic chosen was ethylene and oxygen given by the endotracheal method with avertin as a basal narcotic. Seven cubic centimetres of avertin fluid were dissolved in 268 cubic centimetres of distilled water at 38° Centigrade, This was tested with Congo.red and the reddish colour was unchanged. The avertin solution was introduced into the rectum at 9.23, the administration taking five minutes. A hypodermic injection of morphine 0.008 gm. (gr. 1/8) and hyoscine 0.00032 gm. (gr. 1/200) was given at 9.25. The patient muttered for a few minutes and went to sleep. At 9.45 she was lifted on to a barouche and taken to the operating theatre. After being placed on the table the throat was sprayed with a 10 per cent solution of cocaine, this caused her to move her head and arms as she was not very deeply under the avertin. Ethylene with 25 per cent of oxygen was given with a Heidbrink apparatus for three minutes. A

*Read at the meeting of the Anæsthetic Section of the British Medical Association (South Australian Branch) on May 16, 1933.

INSPECTOR-GENERAL OF HOSPITALS DEPARTMENT.
ADELAIDE HOSPITAL.

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# ANAESTHETIC SHEET.

NAME OF PATIENT, Mrs. N. T. AGE, 27. DATE OF OPN., 23.11.32.
WARD, Alexander

## I. Pre-Anaesthetic Data

Summary of History Diagnosis, etc., as affecting Anaesthesia

Exophthalmic Goitre.
Has had treatment with Lugol's Iodine Solution.
B.M.R.—Read's Formula +48 Gale's +53.

Nature of Operation:—Subtotal thyroidectomy.

### Information for Anaesthetist

RESPIRATORY: Respns., 20 Dyspnoea Stridor Cyanosis

Pulmonary or Pleural Affections

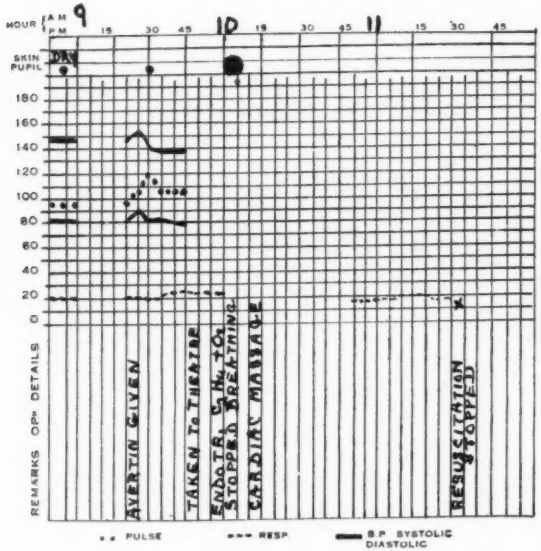
CARDIO CIRCULATORY: Pulse, 96 B.P. { Systolic 148 / Diastolic 80 } Pulse Press., 68

$$\text{Ratio} \frac{\text{P.P. x 100}}{\text{D.P.}} = 85$$

Oedema or other signs of Cardiac failure

RENAL Urine Bladder emptied at..... S.G. 1022 Alb. Sugar Diacetic Acetone
C.N.S. Pupils Prelim. Injection, M/8. H/200 at 9.25. Artificial Teeth

## II. Condition During Anaesthesia




Anaesthetic:
1. Avertin.
2. $C_2H_4 + O_2$ endotracheal.

Surgeon:
H. R. Pomroy.

Anaesthetist:
Gilbert Brown.

Anaesthetic Clerk

Opn. Performed

See Record 874.

Death before Operation begun.

## III. Post-Anaesthetic Data

Regained Consciousness at ..... Vomiting { None ..... / Slight ..... / Excessive ..... } Circulatory Depression { 1st ..... / 2nd ..... / 3rd ..... }

Convalescence normal except for.....

rubber tube (calibre 30 French) was then passed through the nose into the trachea, under the guidance of the laryngoscope, and was attached to the apparatus. The head and shoulders were raised and a pillow placed so as to extend the neck. Just as this was completed (10.0 a.m.) it was noticed that the colour was dusky, so pure oxygen was insufflated through the tube. However, the respiration had ceased, no pulse could be felt, the pupils were widely dilated and the corneal reflex was absent. The administration of oxygen was continued and artificial respiration begun. Coramine was injected intramuscularly, the head of the table lowered and 1.0 c.c. of adrenalin injected into the heart. At 10.10 the abdomen was opened by Dr. John Close and the heart was massaged through the diaphragm. A little later the diaphragm was incised and direct cardiac massage applied and continued until 11.36. Although the heart could be felt to flutter at times, no proper beat could be detected. The colour improved and coramine 1.0 c.c. was injected into the external jugular vein on two occasions. Two further injections of 1.0 c.c. of adrenalin were made into the heart, the needle being felt in the heart by the massaging hand. Carbogen 10 per cent was given intermittently tnrough the endotracheal tube and the bowel was washed out with copious amounts of a warm solution of sodium thiosulphate.

A few shallow natural inspirations occurred at intervals and at 11.10 the left nostril and the throat were noticed to show signs of movement, and shallow natural respirations could be heard through the endotracheal tube at the rate of 18 per minute. The rate increased to 20 per minute and continued until 11.25 when respiration gradually became slower and more shallow until it ceased at 11.33. Resuscitation was then abandoned. The coroner did not hold an inquest and no autopsy was permitted.

Some weeks later Dr. S. R. Hecker, of Brighton, who sent the patient into hospital, provided the information that she had exhibited a marked effort syndrome. She had been unable to walk for more than a very short distance without developing palpitation and breathlessness. Moreover, after a slight cold it was necessary to keep her in bed for three weeks.

The actual cause of death could not be determined.

This was not a typical Avertin death as in the reported cases it has been shown that the respiration is the first to fail and the heart stops from anoxæmia after an appreciable interval. The amount of avertin administered was slightly less than the basal dose of 0.1 c.c. per kilo, yet it has been recommended that larger doses should be given to thyrotoxic patients. The circulation was not greatly depressed, for the chart only showed a fall of systolic blood.pressure of 14 m.m. in 255 minutes. The basal narcosis was not unduly deep as the patient moved her head and arms when the mouth was opened to spray her throat. Death from a basal dose of avertin presupposes an idiosyncrasy on the part of the patient which should have become manifest earlier. Waters, of Madison, Wisconsin, who has studied the oxygen consumption under different anæsthetics, has found that avertin requires a much greater oxygen intake than does any other anæsthetic. He has noted in measuring the oxygen consumption in cases receiving avertin-ethylene that the oxygen requirement is always out of proportion to that which would exist were ethylene the only anæsthetic. In this patient the oygen percentage was never less than 25.

The impression that this patient died from primary cardiac failure receives some support from the fact that the efforts at resuscitation were responded to more by the respiratory than the circulatory system. There had been thyrotoxicosis, and a thyrotoxic heart may fail when any additional load is added. This may have been supplied by the avertin, the morphine and hyoscine, whose maximum effect would be manifested at about the same time, the administration of a general anæsthetic, the cocaine or the movements required in lifting the head and shoulders to insert the pillow. Although the toxic effects of avertin are usually directed towards the respiration, they may also affect the circulation. But it might be expected that even a thyrotoxic heart would have failed more gradually if it had been due to this cause. The dosage of morphine and hyoscine was small for a patient of 71.2 kilo (157 lb.). Cocaine syncope is unusual, except after injection, but has been reported after packing the nose and from instillation into the urethera.

Death from heart failure has been noted under anæsthesia from sudden movements in patients suffering from damage to the myocardium.

The symptoms do not suggest chronic cardiac failure secondary to chronic anoxæmia, nor does the blood-pressure chart support this view. Every effort was made to prevent anoxæmia by employing endotracheal technique with a large tube (30 French) and combining the ethylene with 25 per cent of oxygen. However, several respiratory depressant drugs were used: avertin, morphine, hyoscine, cocaine and (?) ethylene. The combined effect of these drugs may have so depressed the respiratory centre that some anoxæmia was present in spite of the high percentage of oxygen administered and the fact that the colour was good. A thyrotoxic heart withstands anoxæmia badly and any additional temporary increase of this might cause the heart to fail suddenly.

Criticism of the methods of resuscitation suggests that the cardiac massage was not begun soon enough, as approximately 10 minutes had elapsed. Complete recovery is uncommon after a waiting period of five minutes and is almost unknown after eight minutes. Adrenalin was injected into the heart, although it has been shown that the combination of avertin and adrenalin may of itself cause ventricular fibrillation.

SUMMARY.

1. A death is reported under anæsthesia of ethylene and oxygen combined with avertin basal narcosis.
2. The possible causes of this death are discussed.

# OBSERVATIONS ON AVERTIN NARCOSIS.

By Dr. K. E. MADAN, M.D., D.O.M.S.

*Lecturer in Anæsthetics, K.E.M. College, and Senior Anæsthetist, Mayo and Albert Victor Hospitals, Lahore.*

IN a large number of cases avertin was given by me in the hospital in almost all kinds of operations without any fatal results. In slight degrees of liver and kidney diseases, avertin was not found harmful. In cases of suppuration in the gall-bladder, marked jaundice, in cases of slight kidney inefficiency, and in malignant diseases of other organs of the body except liver and kidney, the results of avertin were good.

The technique adopted was modified on various occasions. When a much smaller dose than one mentioned in the table (calculated as 1½ grain per kilogram) was given, it was mostly noticed that patients were slightly drowsy and could talk or move about after half an hour, and were aware of the inhalational anæsthesia administered to them. Hence in these cases there was no retrograde amnesia. In cases where a slightly smaller dose than that given in the table was administered to patients, it was noticed that the subsequent dose of general anæsthesia was much reduced, and there was retrograde amnesia in nearly all the cases.

In cases where preliminary injections of morphia were not given, more struggling was found as soon as inhalation anæsthesia was started than in cases where it was injected beforehand. However, the dose of morphia must not be more than ¼ grain, and it may preferably be preceded by a non-depressing hypnotic the night before the operation. A mild degree of cyanosis before and during the operation was sometimes observed in cases where morphia was given, but a clear airway and use of as little $CHCl_3$ as possible helps in avoiding the cyanosis.

Due to great variability in individual sensitiveness, the induction period may be anything from five minutes to one hour after avertin injection. It will be noticed by those who have any experience of avertin that even after half an hour's delay after the administration of avertin, though the conjunctival or even the corneal reflex is gone, the patient usually moves during the incision, so it is better to give in all cases what I call a provocative dose of ether inhalation as a test to see if the patient is really under.

As regards the subsequent inhalation anæsthesia, in almost all cases the quantity of ether administered is diminished, as only about one-fifth of the amount is necessary, if avertin is acting properly. It is very dangerous to aim at securing complete anæsthesia with avertin alone. Had it not been for the great fall in blood-pressure (sometimes as much as 40 mm. from the original) and the respiratory depression entailed by avertin, complete anæsthesia would have been possible with it alone.

In prolonged operations in debilitated subjects, the use of morphia, avertin, ether and oxygen or $N_2O$ and O sequence is far safer and more satisfactory than only inhalation anæsthesia, because the quantity of the latter used is, as mentioned above, considerably reduced.

There is no doubt that in some big prolonged operations lasting for nearly two hours, the toxic effects of inhalation anæsthesia, if alone administered, would have subsequently carried off the patient, but the combination of basal and general anæsthesia has saved their lives. The combination of basal, local, and a little inhalational anæsthesia should be, according to me, the method of choice in prolonged operations in weak subjects, because it works quite satisfactorily and the parietes are well relaxed.

To counteract as much as possible the early fall of blood-pressure that invariably follows avertin, it has been my practice to give intramuscular injection of ephedrine (grain $\frac{3}{4}$) as soon as the dose of avertin is administered, and I have not found any diminution of the effect of the basal anæsthetic by this procedure. The blood-pressure may fall to 30 mm. or, rarely, less, but with proper management of the case it should rise again. When blood-pressure keeps

on falling due to hæmorrhage or other reasons, there is no sure and speedy means at our disposal to make it rise again to normal, but lowering the head-end of the table, intravenous gucose-saline, ether, oxygen inhalations and injections of ephedrine, pituitrin, cardiazol, etc., are quite useful.

In some cases the blood-pressure actually rises and remains higher than the original, and the pulse-pressure is maintained. In other cases the pulse-pressure has gradually come down to only 15, though to begin with it was 45.

$CHCl_3$, if used as an inhalation anæsthetic, produces a slow and certain fall of blood-pressure, and so it is dangerous; but to counteract this, one should not be tempted to inject adrenalin, as whether the anæsthesia is light or deep, ventricular fibrillation may occur, causing death.

As regards the congo-red colour test, the need for it seems to me much exaggerated, as is the idea that it is very essential to diagnose fresh non-toxic solutions, because I tested avertin solution prepared a week previously by me and also heated to a temperature much exceeding the usual safe temperature, and yet did not find the blue coloration due to its disintegration into poisonous substances.

# A REPORT ON THE CLINICAL VALUE OF "EVIPAN."

*(From the Anæsthetics Committee, Medical Research Council and Royal Society of Medicine.)*

ENCOURAGING accounts of the action of yet another barbiturate anæsthetic, "Evipan," which came from German surgeons and anæsthetists seemed to the Anæsthetics' Committee to warrant a thorough clinical trial. Twenty-five thousand cases are reported from that country with one death attributed to "Evipan". Accordingly the offer of Bayer Products, Ltd., was gladly accepted and supplies of the new drug were put at the disposal of the Committee. In making use of these the Committee had the co-operation of a number of anæsthetists who have sent details of their cases, and the opinions which they have formed. At St. Bartholomew's, Messrs. F. T. Evans and Rait-Smith; at Guy's, Mr. R. C. Brock; and at St. George's, Messrs. Douglas Belfrage and E. Landau have assisted in this way, and Dr. J. M. Barlet, Mr. C. Borland and Mr. R. Jarman are others who, with Mr. C. Pannett and Sir Francis Shipway, Dr. C. F. Hadfield, and Dr. J. Blomfield, members of the Committee, have furnished the material for this report. Evipan sodium is the sodium salt of F-methyl-C-C-cyclo-hexenyl-methyl barbituric acid, and dissolves freely in water, but the solution is stable only for an hour or two. Thorough pharmacological work carried out in Germany showed the drug to have a high therapeutic quotient in cats and dogs. In the former 25 mgr. gave full anæsthesia, while the lethal dose was from 100 to 110 mgr., a quotient of four, and in dogs the quotient was 3.3. Parsons found that in the cat 0.1 c.c. of a 10 per cent solution caused a fall in blood-pressure of 25 mm. Hg. with slow recovery, and apnœa for 20 seconds. After a total of 0.6 c.c. of 10 per cent solution artificial respiration

was needed and the blood-pressure fell until death. The anæsthetic action of the drug was rapid in onset and short in duration. It is not a volatile anæsthetic, but it is very rapidly detoxicated by the liver. Rabbits decompose half the narcotic dose within 13 minutes. Traces of the unchanged substance are excreted in the urine. By-effects in animals were found to be slight. The blood-pressure fell 15 to 20 mm. Hg. The pulse remained regular and full. Overdose caused cessation of the breathing, the heart continuing its beat for a considerable time after. Blood-sugar was unaltered and other evidence of effect on body metabolism was of the slightest.

### Technique and Dosage.

When used for anæsthesia evipan is given intravenously. At first the drug was issued in ampoules, each of which contained 3.5 c.c. of 33⅓ per cent stable solution in methyl-di-glycol. Three c.c. of this contained one gramme of evipan sodium. Ampoules containing 7.5 c.c. of distilled water but capable of holding 10 c.c. were also issued, and before use 3 c.c. of the concentrated solution were drawn into the syringe and expelled into the ampoule containing the distilled water. The evipan solution was sticky and required, therefore, a larger needle than the ordinary hypodermic size. Now, however, the evipan is supplied in powder form in ampoules, to which the distilled water, supplied in another ampoule, is added. By aspirating and re-injecting once or twice a solution is obtained which passes easily through the ordinary hypodermic needle. This is inserted into a suitable vein of the arm with due antiseptic precautions. It is advisable to have the arm held steadily by a second person, because of the twitching of muscle which often comes on early after injection has begun. The solution is run in at the rate of 1 c.c. in 15 seconds. Dosage is determined by the characteristics of the patient and the results noticed. Acting on a definite scale arranged according to body weight does not give satisfactory results. An average amount to produce unconsciousness is about 3 c.c. A good plan, recommended by Lauber, of Konigsberg, who has had a big experience,

is to make the patient count. When the counting ceases through sleep, the amount that has been injected is noted, and the same amount is further added for a short operation, and twice as much for a long one. In elderly and feeble people and those who have gone to sleep exceptionally quickly, only half the amount which produced sleep is added. Most patients are asleep in about one minute. There is often some twitching or jactitation, but often complete relaxation of the muscles of tongue and jaw occurs early, and care is needed to preserve a patent airway. Generally speaking, 10 c.c. are regarded as the maximum dose. When it is desired to complete a longish operation under evipan only, the needle must be left *in situ* and a further injection made when the anæsthetic effect of the first is obviously wearing off. Used in this way as much as 20 c.c. have been injected. There is, however, a fluctuation in the anæsthesia, and we do not see evidence of any advantage in the use of evipan for other than short operations, i.e. of 20 minutes or so at the outside.

### Symptoms Produced.

A deep yawn just before the disappearance of consciousness is a common symptom. The great majority of patients fall asleep perfectly quietly. Twitching of face muscles is common, and there is sometimes jactitation of limbs. In one instance tonic contraction of many muscles and brief stoppage of respiratory movements were observed. The degree of muscular relaxation varies, but is rarely extreme or sufficient for an abdominal operation. The pupil is usually moderately dilated, but active to light. In the early stages it is sometimes widely dilated. The conjunctival and the generally the cornea reflexes have disappeared at the moment of fullest effect. Even then reflex movement at the start of operation has been seen many times. The eyelids are sometimes widely separated.

The effects on blood-pressure are slight. There is commonly a fall of about 20 to 30 mm. Hg., which is quickly recovered from. Respiration is often somewhat slowed, but there has been seen no serious depression except in one instance when, unknown to the anæsthetist,

the patient, an elderly woman, had received a full dose of morphia and hyoscine before the evipan. The combined result was respiratory stoppage requiring, and removed by, artificial respiration and $CO_2$ with oxygen. It is inadvisable to give any sedative before evipan. No special preparation is needed, but it is, of course, desirable to have the stomach empty. Subjective symptoms as described by reliable patients are a feeling of quickly increasing lassitude which cannot be overcome, and loss of consciousness in a few seconds. Experience shows, nevertheless, that it is best to wait two minutes after completing the injection before beginning to operate. The length of time of unconsciousness is usually about 10 to 20 minutes after an average dose. After this time the patient can talk, but is sleepy, and will drop off to sleep again if left quiet. When he finally wakes he remembers nothing after the first prick of the needle.

As in the case of other anæsthetics, there is considerable difference in the reaction of different persons to evipan, and the exact behaviour cannot be foretold. The patient may fall asleep with no apparent difficulty and the usual signs of anæsthesia be present, and yet there may be movement on incision to an extent demanding a supplementary anæsthetic. On the other hand, it often happens that merely 3 c.c. give a perfectly satisfactory, though of course only a short, anæsthesia.

Our experience does not corroborate the statement of Ernst that one can reckon almost always on half an hour's good anæsthesia. We are led to believe that in Germany the surgeon is satisfied with a narcosis which is not regarded as deep enough by most operators in this country. Certainly the German reports describe a more constant and sufficient anæsthesia than has been obtained here by the same dosage and technique.

## Conclusions.

It is obvious from what has been stated that evipan is not to be regarded as a basal narcotic in the sense that, for example, nembutal and avertin are. Its action is so evanescent that it cannot be used as are these drugs for procuring a longish period of quiet or of unconsciousness

before the administration of the anæsthetic proper, nor can it be used as are the basal narcotics to put the patient to sleep in his bed and avoid all knowledge of transference to the operating theatre. If it is used before another anæsthetic this must follow closely on the administration of the evipan, and as a preliminary, therefore, it is to be classed with nitrous oxide and ethyl chloride rather than with the basal narcotics. For those who like intravenous methods it is certainly an admirable means of inducing anæsthesia, all opinion agreeing as to the rapidity and pleasantness with which the patient becomes unconscious. Excitement or restlessness during induction have been seen only in unusually emotional subjects. After-effects also are of rare occurrence. It can be relied on for an excellent anæsthesia in minor surgery, that is for short operations when the possibility of slight reflex movement is not a matter of great concern. It is true that often the anæsthesia is profound, and that by repeating the injection it can be prolonged, but it is not obvious that this is a better procedure than usual methods, such as gas and oxygen for example. The recovery free from after-effects and the quiet induction make evipan a valuable agent in the case of persons gravely ill, for whom a short anæsthesia is desired for any reason. There are many such instances when it would probably be preferable to nitrous oxide even.

Two examples of this kind may be quoted from our series. A man aged 62, suffering from aortic regurgitation and arteriosclerosis, had amputation of the great toe for gangrene. He received 6 c.c. evipan. Sleep was induced in half a minute. The operation took 10 minutes, during which time the anæsthesia was all that could be required. After 20 minutes he woke up yawning, and was talking a minute later. Half an hour later he fell asleep, and slept for six hours. The other example was a man of 36 years, extremely ill with empyema after pneumonia. He was regarded as unfit for a general anæsthetic. Nevertheless it was decided to use evipan, of which 10 c.c. were injected. Anæsthesia was good and the operation, rib-resection, was completed without anxiety. The patient was fully awake after three-quarters of an hour and suffered no after-effects.

A few trials have been made of the efficacy of evipan by the mouth. It is described as proving less efficient thus given than nembutal in the same circumstances. Nevertheless two or three of the tabloids in which it is provided for oral administration are a useful hypnotic, generally causing sleep in a short space of time. It is a useful agent with which to break a habit of sleeplessness.

## CHLOROFORM "BRISETTES."

THE whole question of anæsthetics in obstetrics is at present awaiting decision, not from the scientific standpoint, but from the practical. We know the ideal to be aimed at in accordance with the scientific facts of anæsthesia. The difficulty is to bring that ideal, or something approaching it, into realisation at confinements in general. We are not here attempting any elucidation of the practical problem, or to give any advice thereon, more especially as we know that the subject is to be debated, on Dr. Howard Jones' motion at the next General Meeting of the Association of Anæsthetists. What we wish to contribute, however, is a note on the excellent reports which we have received as to the value of the chloroform "brisettes" issued by Messrs. J. F. Macfarlan and Co. Doubtless many of our readers have tried these for themselves. They contain 20 minims of chloroform, which are released in the manner made long familiar by the similar nitrite of amyl capsules. Contributors assure us that they have found the brisettes a convenient form in which to provide analgesia in early stages of labour. They have been employed with strict injunctions to the nurse as to the number that might be used within a stated time and with the strict proviso that never more than one was to be used in the course of an individual pain. With these restrictions we cannot imagine that 20 minims of chloroform will ever be dangerous. It would, however, be a very different thing to put an unlimited supply of "brisettes" at the command of a nurse or midwife conducting a confinement on her own responsibility. The possibility of future arrangements of this kind will no doubt form part of the debatable material at the next meeting of the Association to which we have referred. In the meantime "brisettes" are a most convenient addition to the midwifery bag of the practitioner who works single-handed.

## ABSTRACTS.

*Coramin in high doses as an awakener in avertin narcosis.* DR. H. DIENZ. *Deutsch. Medizin. Wochensch.* June 30, 1933.

Coramin is well recognized as an effective antidote for respiratory depression consequent on overdosage with avertin. The writer brings additional testimony to the value of this drug in conjunction with avertin for avoiding complications and for shortening the post-operative sleep. He gives us a routine 5 c.c. coramin intramuscularly at the end of the operation. The result is, he says, that the after-sleep is a light superficial unconsciousness of from one-half to two hours, during which the patient can be awakened if desired. The immediate effect of introducing coramin is a deepening of respirations and a rosy colour of the patient's face. Often after a few minutes the patient opens his eyes and then drops off again into a light sleep.

*Decomposition of anæsthetic ether.* H. O. NOLAN, *Brit. Med. Journ.*, July 15, p. 129.

As a result of experiments it has been proved that hydroquinine has remarkable powers in preventing the decomposition of ether; it is also odourless and nonvolatile and harmless to the patient. Added to ether in the proportion of half a grain (a very small pinch) to four ounces, it is a certain method of preventing oxidation. Excess is harmless.

*Present status of ether regarding its impurities.* W. B. NEFF, *Canadian Med. Assoc. Journ.*, June, p. 627.

In association with the last abstract should be read the work of Neff, of Montreal, who has subjected to delicate chemical tests for peroxide and aldehyde over a hundred samples of ether from well-known Canadian and American manufacturers. The results showed that the ethers supplied by these firms are of a high grade and come out well from

most severe tests. The author thinks that ether should not be used after standing more than two days in a gas machine.

*Oral administration of nembutal.* F. F. WADDY, M.B., *Brit. Med. Jour.*, Aug. 5, p. 234.

The author recommends giving the drug in cachets with a small drink of water one hour before operation. At the same time the patient is placed on the trolley and given an injection of atropine. The dose of nembutal given is from three to six grains. Often 1½ grains are given on the night before. The patient is always to be seen by the anæsthetist who is going to employ nembutal before the drug is given. Sex, age, weight, temperament and the disease from which the patient is suffering are taken into account in ordering the dose. A number of illustrative cases are recorded.

*Clinical and experimental study of spinal anæsthesia.* GRODINSKY AND BAKER, *Surg. Gyn. and Obstet.*, August 1933, p. 187.

The authors propound no new theory or explanation of the phenomena following an intrathecal injection. Their object was to determine the factors which decide the distribution of anæsthesia after spinal injection, the blood-pressure and the cause of death. They experimented on the cadaver, and on cats, dogs, rabbits and rats. They found that novocain penetrates further into nervous tissues than the dye with which it was in solution. They arrived at the conclusions that (1) the height of anæsthesia depends on the volume and concentration of the solution used, on the rate of injection, the position of the patient and to a lesser degree on the site of injection. (2) No definite levels for specific volumes and concentrations can be stated for all patients, but by varying these two factors the tendencies of spread can be anticipated. (3) The fall of blood-pressure is dependent on paralysis of vaso-constrictor nerves or centre and not on respiratory depression. Adrenalin and ephydrine acting on sympathetic myoneural functions are effective in preventing and combating fall of blood-pressure. (4) The cause of death following spinal anæsthesia is primarily respiratory, due to action on peripheral respira-

tory nerves or the centre in the medulla. Artificial respiration is the most effective treatment. (5) Spinal anæsthesia causes increase in intestinal movements and tone due to paralysis of the preganglionic sympathetic fibres (splanchnics) which carry the majority of inhibitory impulses to the intestines. This fact may be used clinically in treatment of paralytic ileus.

*Test for purity of avertin solution.* H. K. ASHWORTH, *Brit. Med. Jour.*, Sept. 9, p. 489.

The author believes that avertin solution should be used within one hour of its preparation. He does not consider that the usual congo-red test is sufficiently delicate to demonstrate impurities that may be present after this time, although he admits that these, if not shown by congo red, are probably harmless clinically. The agent recommended as superior to congo-red is "universal indicator" (B.D.H.). The technique of the test is this: Transfer 3 mgr. prepared avertin solution to a clean test-tube and cool. In a similar test-tube place an equal volume of the distilled water used in preparing the avertin solution. Add two drops of universal indicator to the contents of each tube. The colour of the avertin solution should be greenish yellow, and it should not be possible to detect any difference in the colour of the contents of the two tubes.

*Chloroform capsules during labour.* A. REES, *Lancet*, July 29, p. 237.

One hundred unselected cases provide the material for the writer's opinions. He regards it as established that the use of these capsules in the second stage of labour, by midwives, is safe and beneficial to the patient. The best results were obtained if the first capsule was given when definite progress in the second stage had become evident. There is no need to start chloroform early if sedatives have been given in the first stage. This practice is warmly recommended by the author, who is convinced that a relief of mental anxiety and pain during a stage at which the mother can do nothing useful to help herself is of the utmost importance to success in the later stages. He does not think that these capsules can be safely used by a midwife con-

ducting a case alone. He is convinced that the capsules can be a very real danger to mother and child if improperly used. "Taking the country as a whole some different organization to that already in existence seems to me essential if the use of chloroform capsules is to be universally adopted."

*Experimental shock.* J. W. BEARD and A. BLALOCK, *Anæsthesia and Analgesia,* July-August, p. 56.

The authors discuss the mechanism of the production of secondary traumatic shock, a state which has much interest for anæsthetists in their practice, for they often will be left in wonderment as to how little or how great a part their own administration has had in precipitating severe shock after operation. Decline in blood-pressure and diminution of blood-volume are the essential elements of the condition. From their experiments the authors believe that local loss of fluid into the actually damaged area is the most important factor in the production of traumatic shock. The fluid lost into the injured area has approximately the same protein content as that remaining in the blood-vessels. Protein is the substance which maintains the osmotic pressure of the blood, and if you dilute it the result will be further loss of plasma and protein. That is what happens when intravenous injections are given of crystalloid solutions, and consequently the patient's condition may be worse at the end of injection than if no fluid had been given at all. The best method of treatment consists in the transfusion of blood.

*I compenenti del plasma nelle narcosi.* L. CARMONA, *Annali Italiani di Chirurgia,* 30th April, 1933.

The author, having noticed that, notwithstanding that there is plenty of research on the influence of ether and chloroform anæsthesia on the body, can find almost nothing about the effect that these drugs have on the constitution of the blood plasma. He thought it important for many reasons to examine the results and undertook the study of the total nitrogen value, the amount of fibrin and the amount of non-protein nitrogen in the plasma of animals under ether, chloroform and ethero-chloroform

anæsthesias. His researches showed that any type of anæsthesia provokes more or less marked variation in the quantities of the components under examination; but, speaking generally, it is chloroform that causes the more marked changes. With regard to the other anæsthetics investigated these were of little importance.

*Spinal anæsthesia in Cæsarean section.* K. M. HEARD, *Canadian Med. Assoc. Jour.*, August, p. 164.

The article gives an excellent discussion of the pros and cons and detailed results of seventy-four operations. Nine patients had two operations each and two had three. This feature of Cæsarean section, that it is very likely to be repeated, makes it, of course, more important even than usual that the patient should not only make a good recovery but also that her recollection of the anæsthetic shall be a pleasant one. Nitrous oxide and oxygen also proved excellent when they sufficed for the surgeon. This is, however, in only a small proportion of instances; usually enough ether has to be used to vitiate the method from the point of view of the baby's welfare. When, however, the emptying of the uterus can be done with no anæsthetic but the gas then it does not matter much to have to use some ether for the stitching up, as the baby will be unaffected. The undesirable effects of both morphia and ether were shown on the babies in the author's series. He shows, as have other observers, that during spinal anæsthesia rhythmic contractions of the uterus may take place during labour. The writer's conclusions are that both from his own experience and that of other writers spinal anæsthesia stands out well in comparison with other methods for Cæsarean section.

*How are we to avoid the complications of spinal anæsthesia?* Dr. E. KOTTLORS, *Schmerg, Nark-Anæsth.*, March 1933, p. 101.

The author is firmly of opinion that the use of a fine needle, of freshly prepared solutions, and of the strictest asepsis, reduces the complications of intrathecal anæsthesia. In other words he attributes these chiefly to a leptomeningitis set up by the actual injection. He seeks to

establish his opinion by a number of experiments which are described in the article. Headache he attributes to upward spread of the injected solution, when it is not accounted for by meningitis. Other factors which he takes into consideration are the specific gravity of the solution used, its volume and concentration and the force with which it is injected.

In the same volume is a consideration of the use of avertin for children. The author has carried out a number of experiments on young animals. His general conclusion is that the margin of safety is narrower with the young, but that avertin carefully used as a basal narcotic is admirable for children.

# Obituary.

## FELIX S. ROOD.

*Late Senior Anæsthetist, University College Hospital, London.*

THE sudden death of Felix Rood, at the age of 50, has filled his friends with sorrow, and their sympathy goes out unstintingly to his wife and daughter.

In attempting to give a short account of his life and work and to convey some idea of his vivid personality to those who did not know him, one must keep in mind his love of reality and his hatred of pretence. Felix Rood was educated at University College School, then at University College, and University College Hospital, and one may say that during these years he gave little evidence of the ability and amazing capacity for work that characterised his later life. He gained no medals or prizes. He took the M.R.C.S., L.R.C.P. in 1906, and then served as House Surgeon to Mr. Raymond Johnson.

During his term as House Surgeon he gave, as is usual, some anæsthetics, and gradually, owing to his keenness in this branch of work, became more and more in request to assist the honorary anæsthetists.

The position of Anæsthetic Registrar was created to allow him to remain attached to the Hospital.

During the years he served in this capacity he worked with unremitting energy, and attended the operating theatres by day and night, and thoroughly grounded himself in all branches of his speciality.

The moment was opportune, the horizon of anæsthetics was widening, and the days rapidly passing when the choice of an anæsthetic lay solely between chloroform and ether given in a Clover's inhaler.

"Open ether" had been introduced from America, and spinal and local analgesia were beginning to be used.

University College Hospital in those days provided

unrivalled opportunities for an anæsthetist. Professor Barker was engaged there on his pioneer work on spinal analgesia and local infiltrations, and Rood eagerly seized on these opportunities, and mastered the technique of these new ways of producing analgesia. The more so, as he always had the ambition to do surgical work, and these methods gave him the chance of using the skill that lay in his hands.

In view of the possibility of a staff appointment he thought it advisable to obtain a University Degree in addition to his diplomas. Without breaking off his work at the Hospital he took the M.B., B.S., of Durham University in 1911. This necessitated taking all the professional examinations over again from Chemistry to Surgery, as well as attending lectures in Newcastle. This feat he accomplished, often travelling to Newcastle by night to be present at lectures and demonstrations there the next day, and then returning by night to continue his work in the theatres the following morning.

He was appointed an Honorary Anæsthetist to the Hospital in 1912. Rood was one of the first anæsthetists to realize the value of "open ether" as opposed to the older closed methods of administration, and he showed the profound degree of relaxation that can be produced by this method without causing cyanosis or danger to the patient. His skill in induction and maintenance of anæsthesia with open ether enabled him to obtain on the one hand a perfect relaxation, or a light form of anæsthesia closely resembling the type now associated with gas and oxygen. In addition he did some original work on the production of anæsthesia by means of intravenous solutions of saline and ether, and later with intravenous solutions of alcohol. Successful as this work was in certain types of cases, its general application was limited, and this method is seldom used now.

About this time there was evolved the operation for the removal of tonsils by dissection. This gave Rood the chance he had been awaiting. He quickly saw the advantages offered by team work between the surgeon and the anæthetist, and rapidly made himself proficient both in the operation itself and the giving of a suitable anæsthetic for it.

By producing a deep ether anæsthesia obliterating the laryngeal reflexes, he rendered this difficult and, as then little known, operation, easier for the throat surgeon. He emphasized the correct position for the patient to be placed in to prevent blood running down the larynx, and he assumed the responsibility of keeping the airway clear of blood, by mopping for the surgeon. It is perhaps difficult for the present-day anæsthetist, familiar with the orderly and precise modern operation for dissection of tonsils, to realize what he owes to the work of Rood in the early days of this operation. The patient was frequently cyanosed and gagged, and half choked with blood, and the surgeon further handicapped by an imperfect view of his field of operation. Rood's services were greatly in demand, and he was quickly recognized as one of the foremost anæsthetists of his day.

His love of surgery and his manual skill tempted him to assist more and more in the operation for dissection of tonsils, and in some cases his collaboration became such that it was a little difficult for an onlooker to know who was doing the operation and who was assisting. In this way he gradually obtained the experience in tonsil work in particular, and nose and throat work in general, that allowed him in later years to fulfil the ambition of his life and practise as a surgeon in that speciality.

It was only in 1930 that he severed his connection entirely with anæsthetics, and resigned from his position as senior anæsthetist to University College Hospital and devoted himself wholly to his practice of throat and nose surgery. Of his exceptional skill in this branch of work and his busy and successful life as a surgeon it is perhaps out of place to say much here.

Suffice to mention that his dissection of tonsils was carried out with such gentleness and nicety that it is difficult to imagine any great improvement in his technique. Felin Rood possessed the ideal qualities for a doctor. His quick understanding and his genuine sympathy and kindness to his patients, together with his unfailing resolve to do something to help them, gained for him an ever-widening circle of friends.

As a teacher he inspired the students with his own enthusiasm and keenness, and he had the great gift of making whatever he was demonstrating intensely interesting. He was for many years an active member of the Anæsthetic Section of the Royal Society of Medicine, and served his term of office on the Council of that Section.

In association with Dr. Webber he published the well-known handbook "Anæsthesia and Anæsthetics," and he also published from time to time papers dealing with various aspects of anæsthetics.

His kindly humour and his fund of practical common sense made him a charming and helpful colleague, and his loss will be deeply felt by all who knew him.

C. W. M.

The above notice was sent to us by a colleague of the late Dr. Felix Rood.

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## JAMES PATON BOYD.

The death of Dr. James Paton Boyd, of Glasgow, on September 12th, has removed a man who was one of the earliest to practise anæsthetics as a speciality in that city. Dr. Boyd was for many years attached to the Royal Infirmary, but the claims of a large practice, in which he succeeded his uncle, Dr. James Maclaren, and his practice in anæsthetics severed him from hospital work. Besides his professional qualifcations Dr. Boyd had personal merits and charm which endeared him to a wide circle of friends both lay and professional. He was one of the founders and for many years the secretary of the Town and County Medical Club, and was a prominent lay member of the Glasgow Art Club. Dr. Boyd retired from active practice in 1924, but had kept in touch with old professional friends until the end.

## REVIEW.

"The Technique of Local Anæsthesia," by A. G. HERTZLER, M.D., LL.D., F.A.C.S. 5th edition, pp. 292, with illustrations, 25/- net.

In the last edition of this well-established book the chapter on Spinal Anæsthesia has been re-written. Nevertheless we find this the least satisfactory part of the book. It is sketchy and includes, for example, no account at all of the use of percaine. The rest of the book is admirable. The author is no wild enthusiast for local methods, giving excellent reasons for the occasions on which he regards them as the best measures. These are many, but they exclude operations on the abdominal contents, for which he thinks general or spinal better than local methods because of the pain of traction. Also extensive infections anywhere are generally unsuitable in Dr. Hertzler's opinion for local anæsthesia. Amytal, in three-grain doses, on the evening before and again a few hours before operation, is his favourite preliminary treatment. He likes the patient soothed but not doped to unconsciousness. The illustrations and diagrams are excellent and the book is a first-rate guide for the anæsthetist who is keen on local analgesia.